GigaDevice Semiconductor Inc.

GD32W51x Testing Guidelines for RF Indexes and Transmitting and Receiving Power Consumption

Application Note

AN084

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1. Introduction

The testing guidelines are mainly used to guide customers to test transmitted and received RF indexes and power consumption indexes of the Wi-Fi development board of GD32W51x series chip in non-signaling mode.

This document is mainly divided into two parts. The first part introduces the building of the test system, including the configuration of the software and hardware of the development board; the second part introduces the test methods, including the RF index test and the test on power consumption due to transmitted and received RF in non-signaling mode.

2. Test preparation

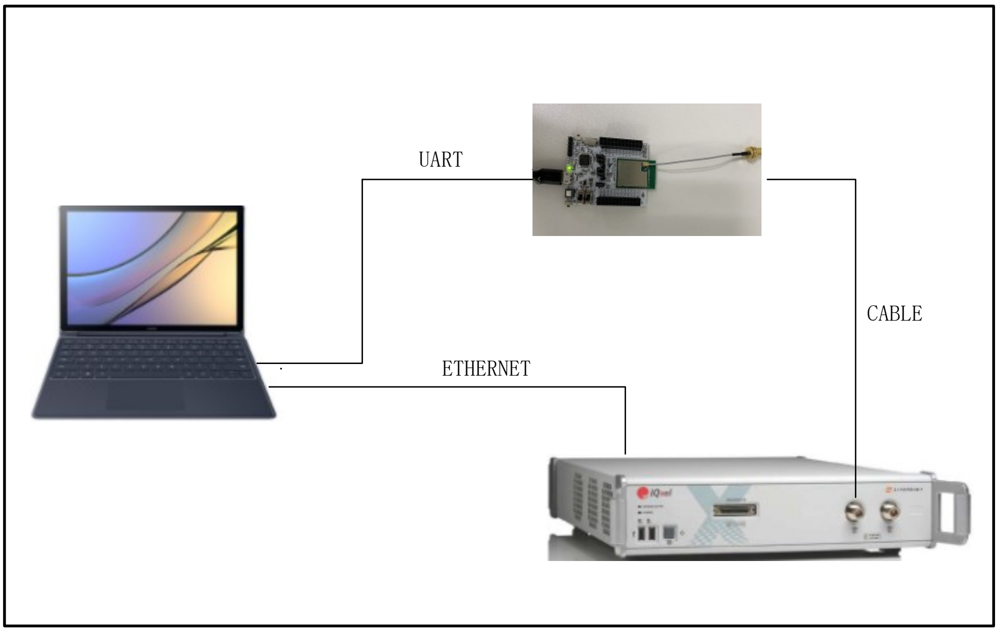
This chapter introduces the preparation for RF test, including the building of the test system and software and hardware platforms, and the hardware configuration section includes the instructions for configuration of the GD32 development board (module).

2.1. System building

The RF test system mainly includes three parts: PC, device under test (DUT), and instrument (***Figure 2-1. RF test system***):

- The RF port of the wireless comprehensive test instrument (such as IQ XEL) is connected to the DUT RF test socket through a RF cable.
- PC controls DUT and the instrument respectively through UART (USB to UART) and Ethernet, and tests the transmitted (Tx) and received (Rx) RF indexes of DUT.

Figure 2-1. RF test system



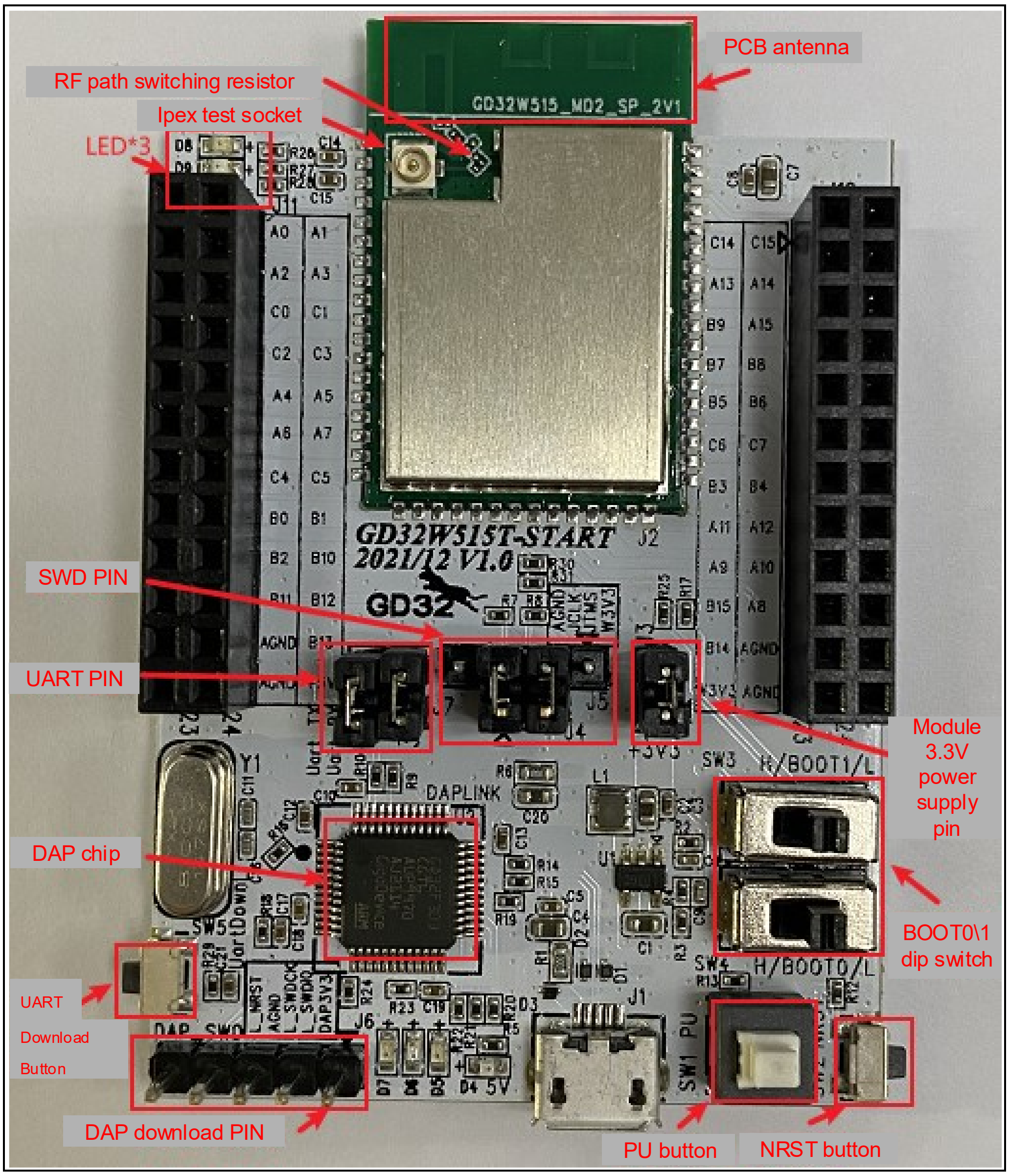
2.2. Hardware configuration

When DUT is a GD32 development board (***Figure 2-2. Reference connection of GD32 development board***, bottom board + module):

- UART & SWD functions: The communication function of USB to UART and the firmware burning function of USB to SWD are realized through the DAP chip circuit on the bottom board, and PC is connected to the USB port of the bottom board through a USB cable;

- Serial port connection: To connect the main chip UART PIN to the DAP UART PIN, use the jumper caps to connect pin 1 to pin 2 and pin 3 to pin 4 of J7 on the bottom board, respectively.
- SWD connection: To connect the main chip SWD PIN to the DAP SWD PIN, use the jumper caps to connect pin 3 and pin 2 of J5 to pin 1 and pin 2 of J4 respectively on the bottom board.
- Configuration of the main chip mode:
  - "BOOT0" of PIN should be at low level (flash in boot mode), which is realized through the DIP switch "SW4" on the bottom board.
  - "PU" of PIN should be at high level, which is realized by "pressing" the switch "SW1" on the bottom board.
- Module antenna switching:
  - Switch the position of the resistor by welding (***Figure 2-2. Reference connection of GD32 development board***) to select the RF signal path of DUT: When the left side of the resistor faces upward, the RF path leads to the PCB antenna and can only be used for radiation test; when the left side of the resistor faces downward, the RF path leads to the RF (Ipex) test socket and is used for conduction test and radiation test of external antenna. This document mainly targets conduction test.
  - Connect the RF test socket of DUT and the RF port of the instrument with the Ipex to SMA cable.
- Module power supply: The DC-DC circuit on the bottom board converts the 5V power input from the USB port into a 3.3V output, and the 3.3V output is connected to the 3.3 V pad of the module through the jumper cap "J3". Disconnect this jumper cap (from external 3.3V output to pin 2 of J3) to test the power consumption of the module.

Figure 2-2. Reference connection of GD32 development board

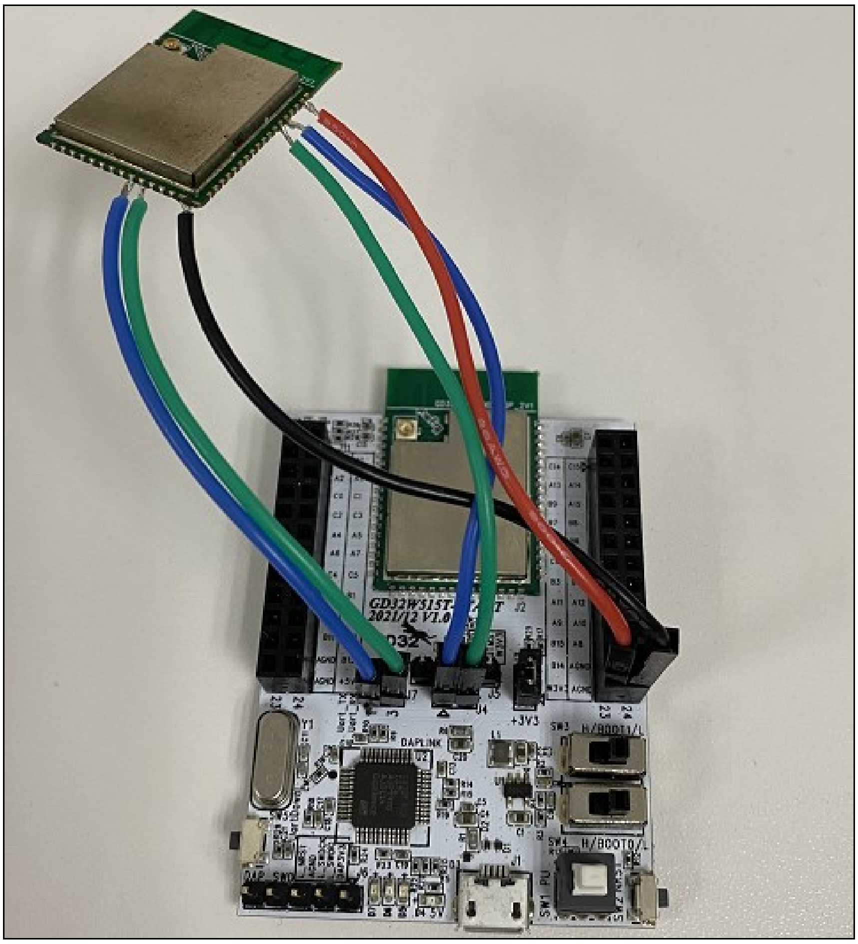


When DUT is a single module (***Figure 2-3. Reference connection of single module***, take the module in the above development board as an example):

- The following pins of the module need to be connected with Dupont wires: 3V3, GND, PB15 / PA8 (UART Tx / Rx for serial port communication), PA13 / PA14 (SWD_TMS / CLK for firmware burning), BOOT0, NRST, and PU (it is recommended to reserve pull-up options on the module for NRST/PU pin, so that no lead needs to be pulled out).
- Configure PIN "BOOT0" of the chip as low level (flash in boot mode) and "PU" and "NRST" as high level.
- Connect PB15 / PA8, PA13 / PA14, 3V3 and GND to pin 1 and pin 3 of J7, pin 2 and pin 1 of J4, and pin 23 and pin 24 of J10 on the bottom board of the GD32 development board respectively with Dupont wires.
- For the configuration of antenna on the module side, refer to point 5 of the above-

mentioned development board configuration.

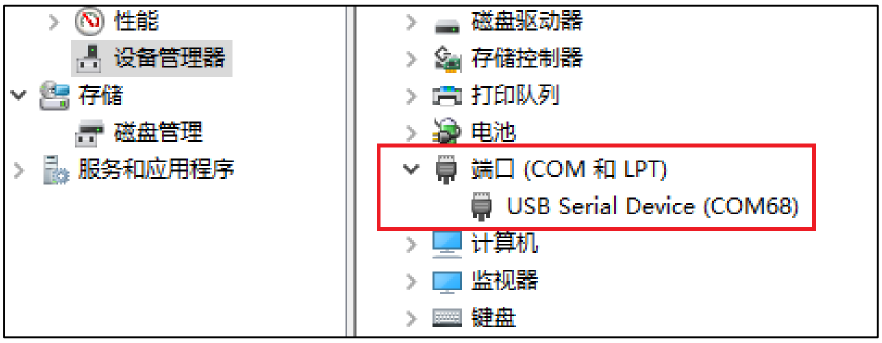
Figure 2-3. Reference connection of single module



2.3. Software configuration

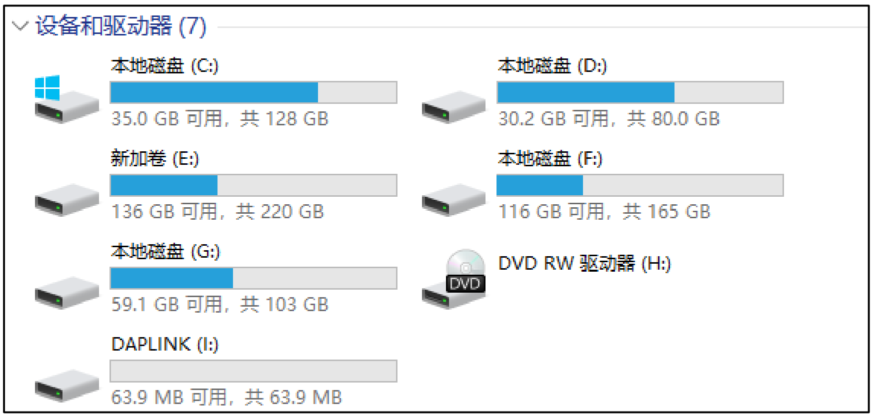
- Drive installation: After the development board hardware and the test system are built, connect the two ends of the USB cable to the development board and PC respectively. First install the DAPLINK drive "**mbedWinSerial_16466.rar**" on PC: After decompression, double-click the .exe file to start automatic installation. After installation, you can see the serial device and COM number (***Figure 2-4. Installation of serial port drive***) in the "**Device Manager**" on PC. It is recommended to install the Windows 10/Windows 7 system on PC.

Figure 2-4. Installation of serial port drive



- Firmware burning: After the DAPLINK drive is installed, you can see the new drive letter "**DAPLINK**" (***Figure 2-5. DAPLINK folder***) in the path of PC-"Explorer". Directly "drag and drop" (or copy and paste) the RF test firmware named "**image-all-rf-test.bin**" to this drive letter, wait for a while to achieve firmware burning, and click **Reset** to restart the chip;

Figure 2-5. DAPLINK folder



- Starting the test: Use the GD RF test tool or the serial port command line to perform subsequent RF index tests (***Figure 2-6. GD RF Test Tool***).

Figure 2-6. GD RF Test Tool

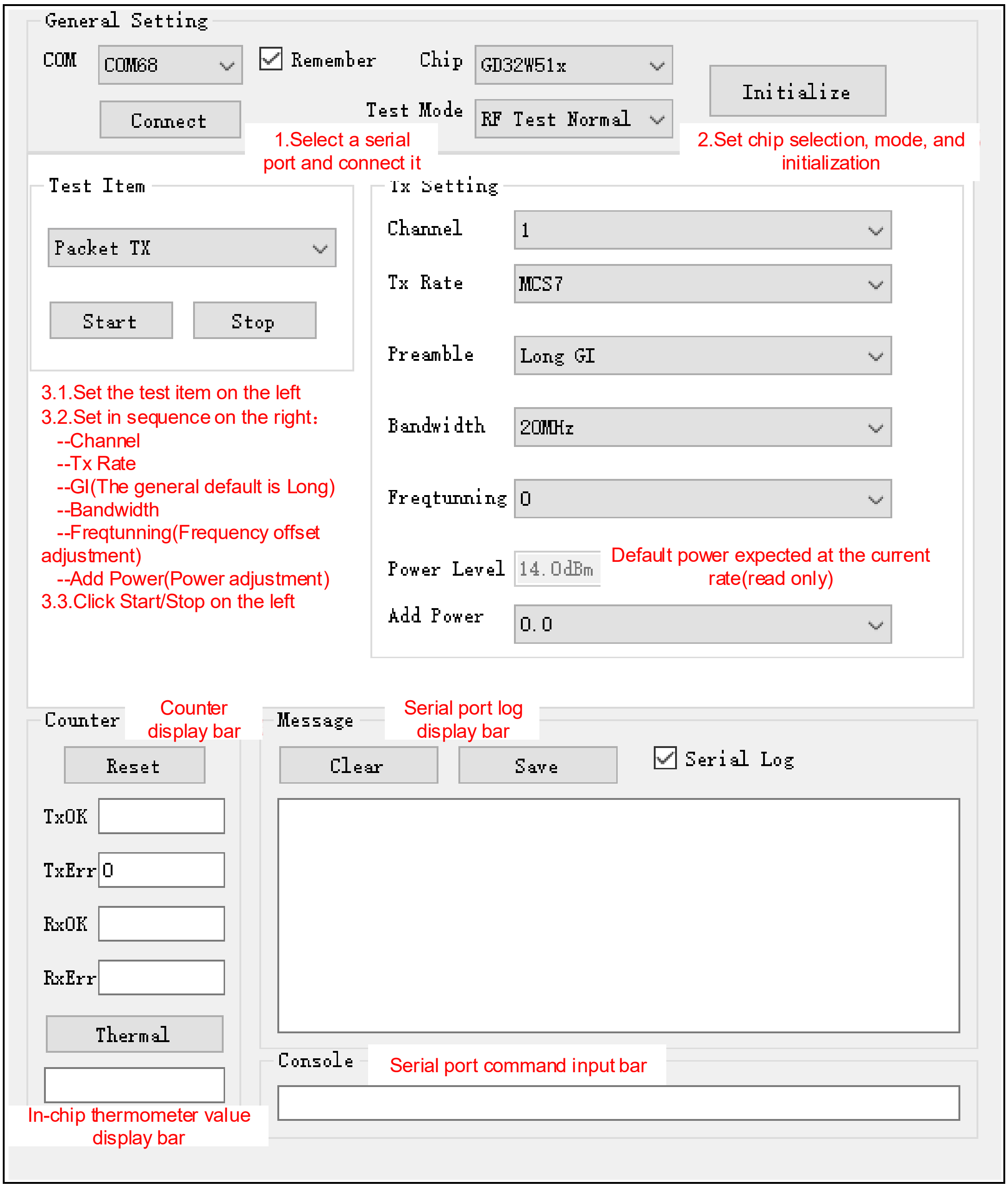
3. Test with RF tools

This chapter introduces how to test transmitted and received RF indexes in non-signaling mode with the GD RF test tools.

3.1. Introduction to tools

Figure 3-1. Instructions for tool functions shows the interface and functions of the first opened RF test tool "**GD RF Test Tool**" (serial port not connected and chip not initialized).

Figure 3-1. Instructions for tool functions



3.2. Test mode setting

- Serial port connection: Select the serial port number of DUT in the drop-down menu of **COM** on the tool interface, click **Connect**, and the text displayed on the button changes to **Disconnect**, which indicates that the serial port is successfully connected, and the **Freqtunning** bar displays the calibrated value. If the serial port connection fails, the log window reports an error.
- Mode setting: There are three test modes according to ***Table 3-1. Test modes***, and the default mode is **RF Test Normal**. Click **Initialize**, and the text displayed on the button changes to **De-initialize**, which indicates that you enter the RF Test Normal mode.
- If the development board is restarted or replaced with another development board for test, repeat the above steps. If **Disconnect** and **De-initialize** are displayed, click the buttons twice in succession to connect the serial port and initialize the chip mode again.

Table 3-1. Test modes

Test mode	Description	RF calibration compensation value	Temperature compensation mechanism
MP mode	For RF calibration test (for PCBs whose RF is uncalibrated/needs to be recalibrated)	Disabled	Disabled
RF Test Normal	For RF index test at normal temperature (for PCBs whose RF is calibrated)	Enabled	Disabled
RF Test Temp	For RF index test at high and low temperatures (for PCBs whose RF is calibrated)	Enabled	Enabled

3.3. Discontinuous packet sending test

This test item is defined as the modulated signal Tx with 50% duty, which is used to test protocol indexes, such as Tx power, EVM, and frequency offset.

- DUT terminal setting: On the tool interface, set **Test Item** to **Packet TX**, set **Channel**, **Tx Rate** and **Bandwidth**, click **Start**, and the chip starts to transmit the Tx RF signal.
- Demodulation setting on the instrument: Refer to point 1 to set **Channel**, **Test Mode**, and **Power Level** on the instrument, and start the test.
- Tx adjustment: To modify the power, first click **Stop** to stop Tx, modify the value in **Add Power** in a step unit of 0.25 db, and click **Start**. At this time, refer to the following formula for the expected power:

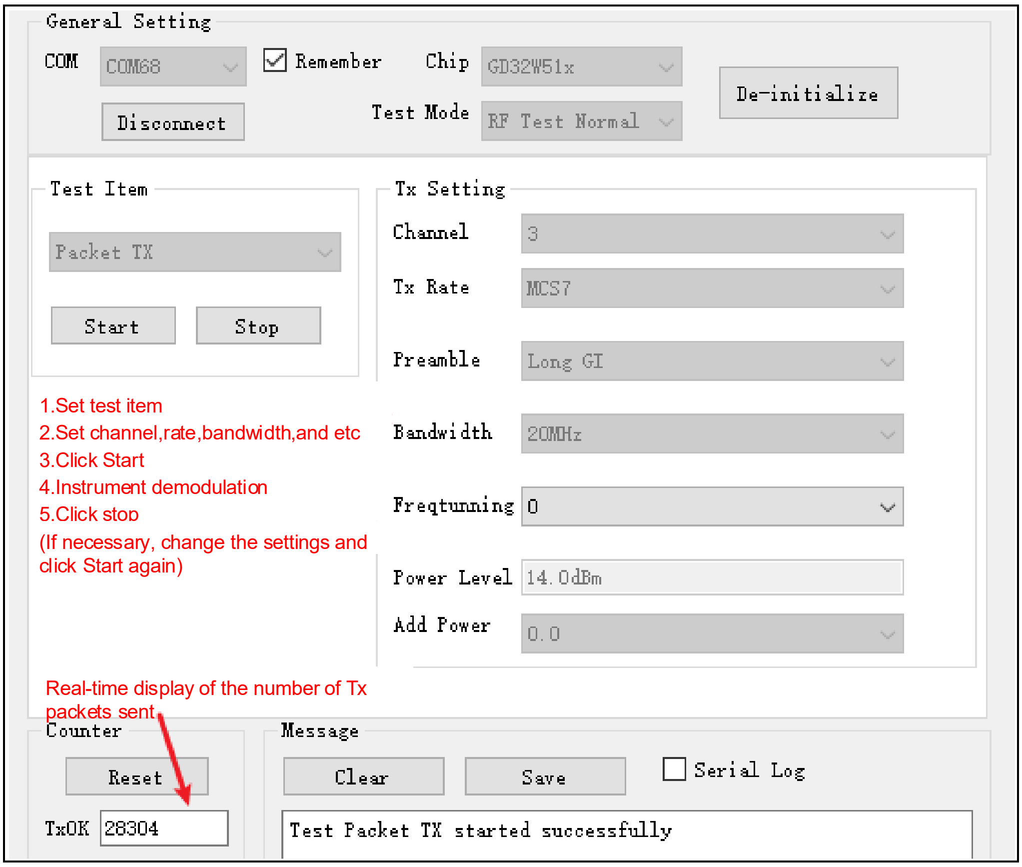
expected power = default power(“power level”value) + power adjustment(“Add Power”value)

To modify the frequency offset, you can adjust **Freqtuning** at the same time. If the frequency offset is a positive value, this value needs to be increased; otherwise, this value needs to be decreased. The value can be adjusted during the Tx process.

- Temperature test (if necessary): Select **RF Test Temp** and reinitialize, and repeat the above steps. Note that the temperature compensation mechanism can take effect only after the Tx is stopped and restarted at different ambient temperatures.

As shown in ***Figure 3-2. Packet Tx Tool setting***, it means setting **Channel** to 3 (2422 MHz), **Tx Rate** to 11N MCS7, and **Power Level** to 14 dbm, and starting **Packet TX**.

Figure 3-2. Packet Tx Tool setting

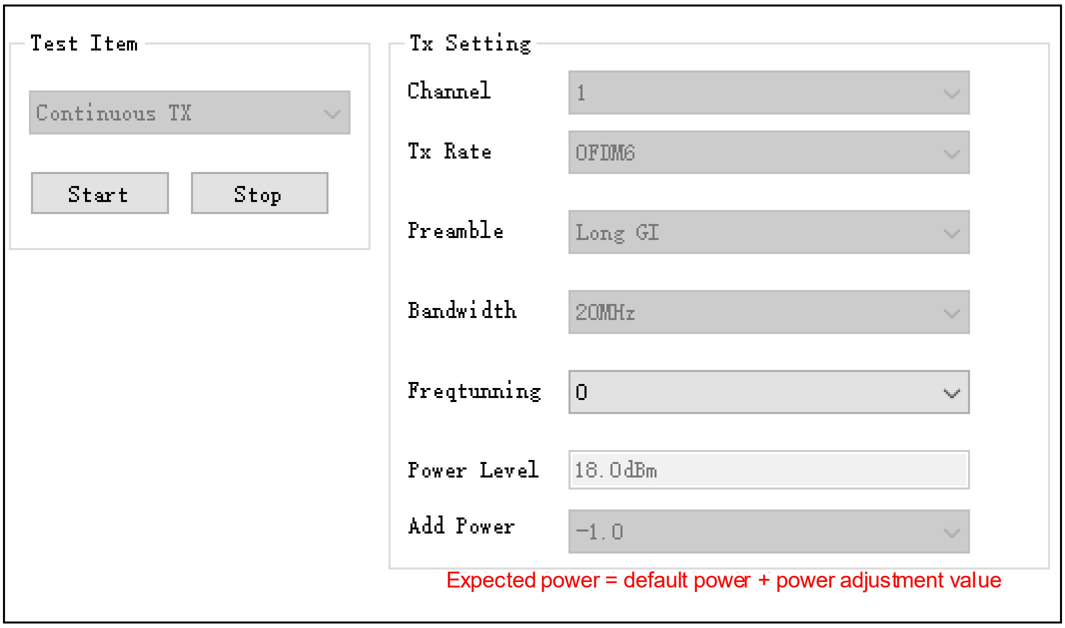


3.4. Continuous packet sending test

This test item is defined as the modulated signal Tx with 100% duty, which is used to test the transmitted spectrum waveform and harmonic characteristics, etc. The method is similar to that of ***Discontinuous packet sending test***, while the difference is that **Test Item** needs to be set to **Continuous TX**.

As shown in ***Figure 3-3. Continuous Tx Tool setting***, it means setting **Channel** to 1 (2412 MHz), **Tx Rate** to 11G 6M, and **Power Level** to 17 dbm (18-1), and starting **Continuous Tx**.

Figure 3-3. Continuous Tx Tool setting

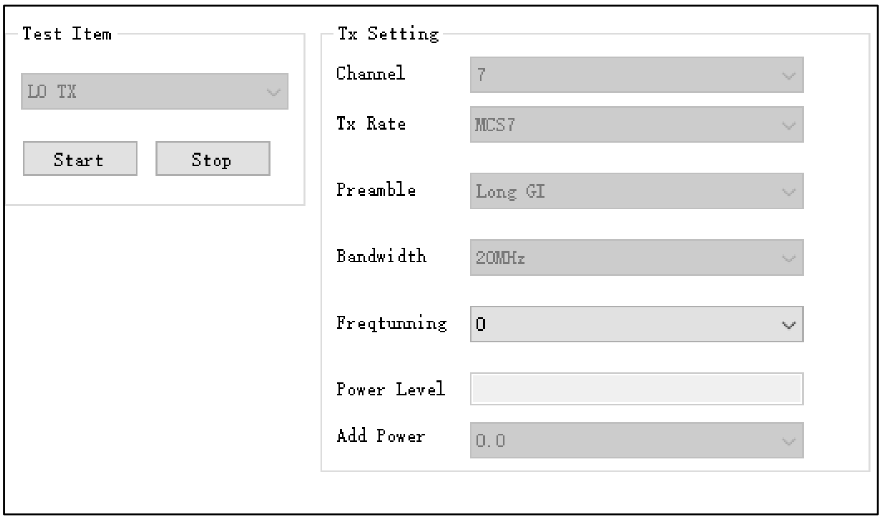


3.5. Single carrier transmitting test

This test item is defined as the single carrier Tx, which is used to test the frequency offset and other indexes. The method is similar to that of ***Discontinuous packet sending test***, while the difference is that **Test Item** needs to be set to **LO TX**, and **Channel** needs to be set. The **Power Level** of this test item cannot be adjusted.

As shown in ***Figure 3-4. LO Tx Tool setting***, it means setting **Channel** to 7 (2442 MHz) and starting **LO Tx**, and you can see the single carrier signal in the spectrometer.

Figure 3-4. LO Tx Tool setting



3.6. Receiving test

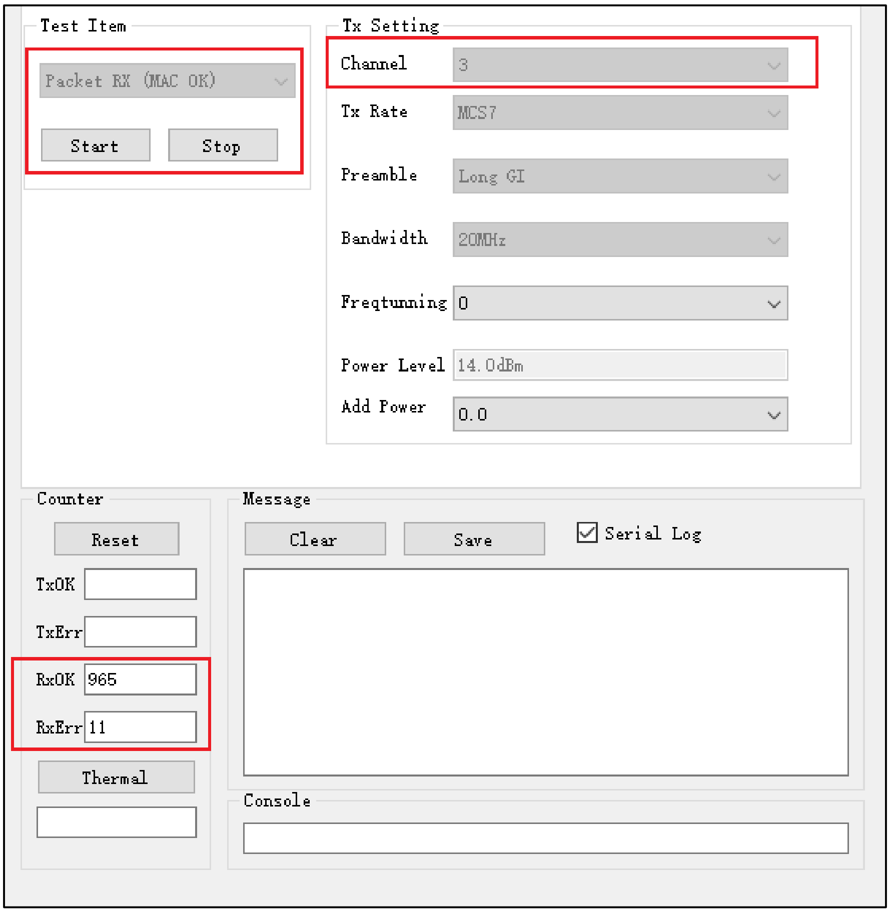
This test item is used to test the received packet error rate (Rx PER), receiving sensitivity, and other indexes in a **shielded room environment** without any interference.

- Set **Test Item** to **Packet RX** and set **Channel** and **Bandwidth**.
- Click **Start** and **Reset** to reset the counter.
- At this time, the instrument has not sent any packet. Observe the numbers shown in **RxOK** and **RxErr** at the lower left corner of the interface for a few seconds to confirm that they are always empty, which indicates that the environment is "clean", and then set the packet sending of the instrument.
- After the instrument has sent packets, record the result of the counter (number of RxOK packets) on the interface, and calculate PER according to the following formula: PER = (number of packets sent by the instrument - RxOK)/number of packets sent by the instrument (the Wi-Fi protocol specifies that 11b rate PER should be less than or equal to 8% and 11g/n rate PER should be less than or equal to 10%).
- If retesting is required, repeat step 2 to step 4.

For the waveform of the instrument used for testing Rx, the recommended values are generally as follows: The packet length is 1024 Bytes and number of packets is 1000.

As shown in ***Figure 3-5. Packet Rx Tool setting***, it means that when **Channel** = 3 (2422 MHz), packet sending rate of the instrument = 11G 6M, number of packets sent = 1000, and **RxOK** = 965, PER = (1000-965)/1000 = 3.5% (< 10%), which indicates that the test is passed.

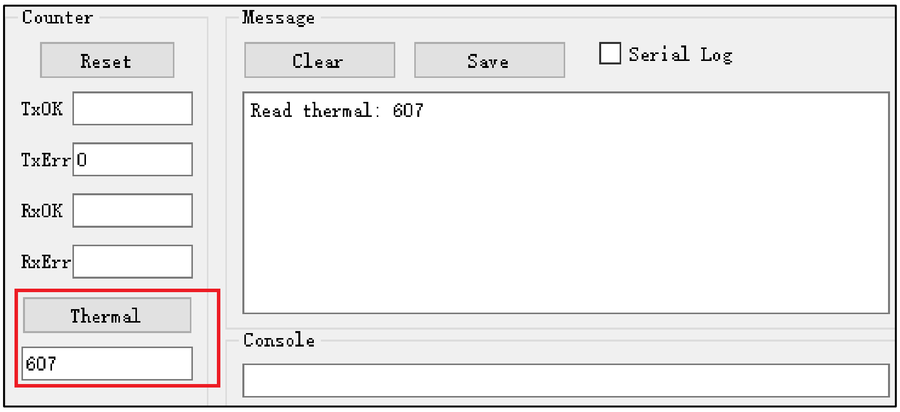
Figure 3-5. Packet Rx Tool setting



3.7. Temperature display

Click **Thermal** to view the real-time return value of the built-in temperature sensor of the chip (*Figure 3-6. Temperature display*). This value is not in the unit of Celsius, but it has a monotonically decreasing relationship with the actual temperature, that is, the larger the value, the lower the temperature.

Figure 3-6. Temperature display



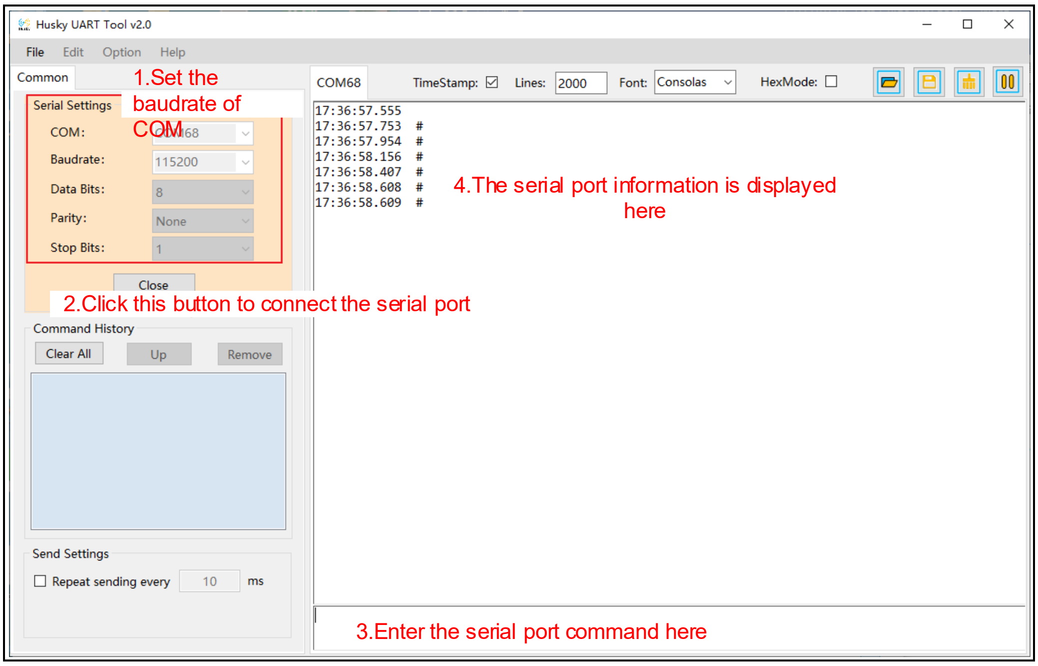
4. Test with serial port commands

This chapter introduces how to test transmitted and received RF indexes in non-signaling mode with the serial port tools and commands.

4.1. Serial port connection

- Open the UART tool on PC (the serial port tool "Husky Uart Tool" of GD is recommended), click the drop-down menu of **COM**, select the COM port of DUT, and the default serial port configuration is as shown in ***Figure 4-1. GD serial port tool***:

Figure 4-1. GD serial port tool



- Click **Open** to connect the serial port. Press **Reset** at the side of the development board, and the serial port output box displays the log information, as shown in ***Figure 4-2. Serial port boot information***. Left-click in the serial port input box and press **Enter** on the keyboard, and the log displays "#":

Figure 4-2. Serial port boot information

```
GIGA DEVICE
MBL: Boot from Image 0.
Current image version is 1.0.0.
SDK first message for GDM32W51x
SDK version: v1.0.0
SDK build revision: 2b81f07d375eda26
SDK build date: 2021/11/23 17:22:48

System reset mode: pin, power on, soft,
WiFi SW init OK.
WiFi RF init OK.
WiFi BB config OK.
WiFi RF calibration OK.
WiFi MAC address: 76:ba:ed:1e:00:1e
wifi netlink: device opened!

#
#
```

4.2. Test mode setting

- To set the test mode, enter the following commands:

CMD format:

- wifi_mp_mode <mode>
- <mode>: 0, normal mode
  1, mp test mode
  2, rf normal test mode
  3, rf temp test mode

- Power on to start the chip to see the default mp mode = 0, enter the serial port command "wifi_mp_mode 2", and press **Enter** (***Figure 4-3. Description of mode setting commands***) to enter the RF Normal Test mode, to conduct regular RF index tests. mode = 1 is suitable for RF calibration test, while mode = 3 is suitable for RF index test at high and low temperatures. For the definition of modes, refer to ***Table 3-1. Test modes***.

Figure 4-3. Description of mode setting commands

```
# wifi_mp_mode 2          Enter RF Normal Test Mode
#
```

4.3. Discontinuous packet sending test

- To set the channel and bandwidth, enter the following commands:

CMD format:

- wifi_set_ch <channel> [bandwidth]

- <channel>: 20M, 1 – 14; 40M, 3 - 11
- [bandwidth]: 20M, 0; 40M, 1
- <> is required, [] is optional, set to 0 if unfilled, the same below;

■ To set **Tx Rate** and **Add Power** and start **Tx**, enter the following commands:

CMD format:

- wifi_tx_duty <percentage> <rate> [add_power]
- <percentage>: 50 or 90, that is, set the Tx duty ratio (%), and 50 is recommended
- <rate>: 0 - 19, refer to ***Table 4-1. Rate and index correspondence***
- [add_power]: -16.0 - 16.0, range = 32 db, step = 0.25 db

Table 4-1. Rate and index correspondence

Rate	Index	Rate	Index
11B 1M	0	11G 48M	10
11B 2M	1	11G 54M	11
11B 5.5M	2	11N MCS0	12
11B 11M	3	11N MCS1	13
11G 6M	4	11N MCS2	14
11G 9M	5	11N MCS3	15
11G 12M	6	11N MCS4	16
11G 18M	7	11N MCS5	17
11G 24M	8	11N MCS6	18
11G 36M	9	11N MCS7	19

■ The instrument demodulates the signal and obtains the required data.

■ To stop Tx when the test is completed (or to add power), enter the following command, as shown in ***Figure 4-4. Description of Packet Tx test command***. The expected Tx power equals 14.25 dbm (14 + 0.25).

CMD format:

- wifi_tx_stop

■ To adjust the frequency offset, enter the command "wifi_get_crystal_cap". First read the currently set parameter value "tune" (decimal), and then adjust it based on this value by using the "wifi_set_crystal_cap" command. If the measured frequency offset is positive, the parameter value "tune" (hexadecimal) must be larger than the original value, so adjust it in the positive direction; otherwise, adjust in the negative direction.

CMD format:

- wifi_get_crystal_cap
- wifi_set_crystal_cap <tune>
- <tune>: '+': 0x00 - 0x3f, indicating the range: 0 to 63
- '-': 0x40 - 0x7f, indicating the range: -64 to -1

Figure 4-4. Description of Packet Tx test command

```
# wifi_set_ch 3 0          1.Set the channel to 3 and bandwidth to 20M
set primary channel to 3, bandwidth is 0, channel offset is 0
#
#                          2.Set duty cycle to 50%, rate to MCS7, Power adjustment to
# wifi_tx_duty 50 19 0.25  +0.25db, start Tx
wifi_tx_duty: packet duty tx started
# rate:19, power level: 14.000000dBm, add_pwr: 0.250000dB

#                       3.Set instrument demodulation signal and obtain required data
#
# wifi_tx_stop          4.Stop Tx
wifi_tx_stop: tx test is to be stopped
#
```

4.4. Continuous packet sending test

- To set the channel and bandwidth, enter the same command as ***Discontinuous packet sending test***;
- To set **Tx Rate** and **Add Power** and start **Tx**, enter the following commands:
  - CMD format:
  - wifi_cont_tx <rate> [add tx power]
  - <rate>: 0 - 19, refer to ***Table 4-1. Rate and index correspondence***
  - [add tx power]: -16.0 - 16.0, range = 32db, step = 0.25db
- The instrument receives the signal and obtains the required data.
- To stop Tx when the test is completed or to add power, enter the same command as ***Discontinuous packet sending test***, as shown in ***Figure 4-5. Description of Continuous Tx test command***. The expected Tx power equals 17.75 dbm (18-0.25).

Figure 4-5. Description of Continuous Tx test command

```
# wifi_set_ch 7 0          1.Set the channel to 7 and bandwidth to 20M
set primary channel to 7, bandwidth is 0, channel offset is 0
#
#                          2.Set rate to 11G 6M, Power adjustment to +0.25db, start Tx
# wifi_cont_tx 4 -0.25
rate:4, power level: 18.000000dBm, add_pwr: -0.250000dB
wifi_cont_tx: continuous tx started.
#                  3.An instrument (such as a spectrum analyzer) is set up to receive the signal and
#                  obtain the required data
# wifi_tx_stop                  4.Stop Tx
wifi_tx_stop: tx test is to be stopped
#
```

4.5. Single carrier transmitting test

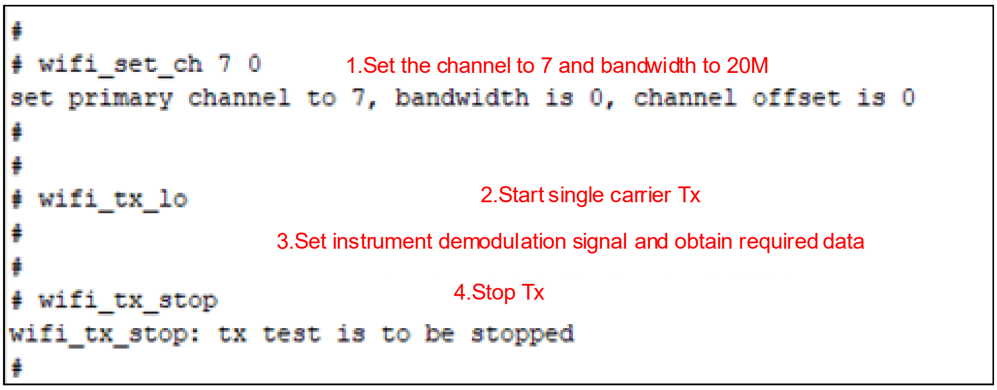
- To set the channel and bandwidth, enter the same command as ***Discontinuous packet sending test***;
- Enter the following command to start Tx:

CMD format:

– wifi_tx_lo

- The instrument receives the signal and obtains the required data.
- To stop Tx when the test is completed, enter the same command as ***Discontinuous packet sending test***, as shown in ***Figure 4-6. Description of LO Tx test command***.

Figure 4-6. Description of LO Tx test command



```
#
# wifi_set_ch 7 0          1.Set the channel to 7 and bandwidth to 20M
set primary channel to 7, bandwidth is 0, channel offset is 0
#
#
# wifi_tx_lo                          2.Start single carrier Tx
#                  3.Set instrument demodulation signal and obtain required data
#
# wifi_tx_stop                        4.Stop Tx
wifi_tx_stop: tx test is to be stopped
#
```

4.6. Receiving test

- To set the channel and bandwidth, enter the same CMD as ***Discontinuous packet sending test;***
- Enter the following command to start the receiving test (clear the receiving counter):

CMD format:

– wifi_reset_trxc

- Enter the following command to read the number of packets received by the chip (the number of RxOK and RxError packets, which should be converted from hexadecimal number to decimal number). First make sure that the counter has been reset to zero, and then set the packet sending rate of the instrument to 11G 6M, **Power Level** to - 94 dbm, packet length to 1024Bytes, number of packets to 1000.

CMD format:

– wifi_mac_rxc

- After the instrument has sent packets, enter the command in step 3 to obtain the number of packets received by the chip, and calculate the PER according to the following formula: PER = (number of packets sent by the instrument - number of RxOK packets)/number of packets sent by the instrument.
- If retesting is required, repeat step 2 to step 4, as shown in ***Figure 4-7. Description of Packet Rx test command***. 0x3dd equals 989, PER equals 1.1% ((1000 - 989)/1000), which indicates that the test is passed.

Figure 4-7. Description of Packet Rx test command

```
#
# wifi_set_ch 3 0
set primary channel to 3, bandwidth is 0, channel offset is 0
#
#
# wifi_reset_trxc
#
# wifi_mac_rxc
MAC RX OK: 0x00000000 CRC ERR: 0x00000000  REPORT: 0x00000000
#
# wifi_mac_rxc
MAC RX OK: 0x000003dd CRC ERR: 0x00000010  REPORT: 0x000003dd
#
# wifi_reset_trxc
#
```

1.Set the channel to 3 and bandwidth to 20M

2.Clear the receiving counter

3.Confirm the counter is cleared to zero and set the instrument to Send packets

4.After the instrument has sent packets,obtain the number of packets received by the chip, and calculate the PER

5.If retesting is required, repeat step 2 to step 4

4.7. Temperature display

Enter the following serial port command to display the return value of the built-in temperature sensor of the chip in real time, usually 600 - 650 (as shown in ***Figure 4-8. Description of temperature display command***). This value is not in the unit of Celsius, but it has a monotonically decreasing relationship with the actual temperature, that is, the larger the value, the lower the temperature.

CMD format:

– wifi_get_thermal

Figure 4-8. Description of temperature display command

```
#
# wifi_get_thermal
wifi_get_thermal:
609
#
```

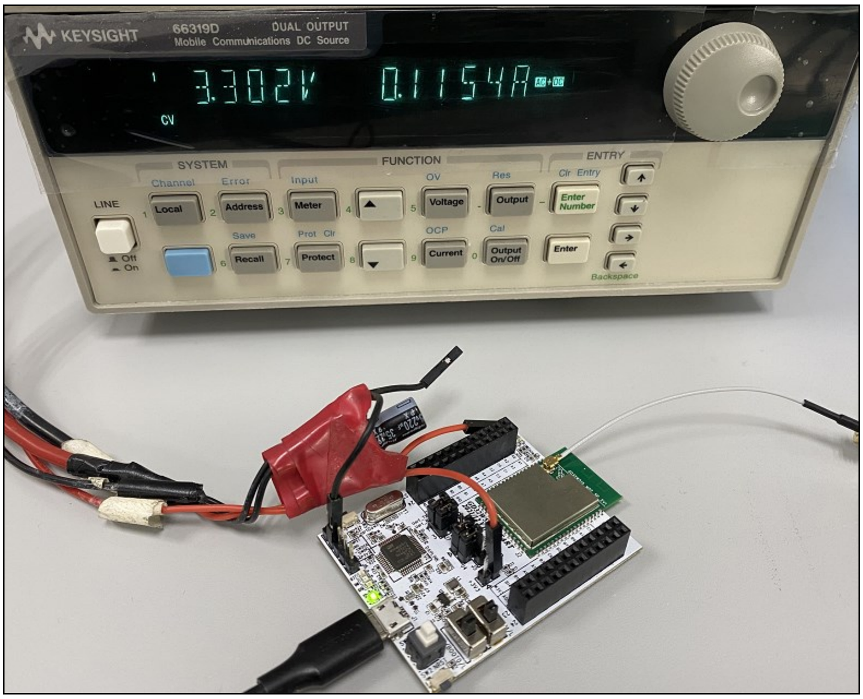
5. Receiving and transmitting power consumption tests

This chapter introduces how to test power consumption due to RF Tx and Rx in non-signaling mode with the RF test tools and the DC power supply.

5.1. Test preparation

- Test system: Based on ***Figure 2-1. RF test system***, a DC power supply is required to supply power to the module and record current data in real time, such as Keysight 66319D (this device is also used for the power consumption tests below);
- Instrument configuration: It is mainly for the DC power supply, and the end of the power cable is welded with a Dupont wire for transfer. For stable output voltage, it is recommended to weld a large electrolytic capacitor (such as 100 uF) at the end of the power cable. After the instrument is powered on, first set the output voltage of the instrument to 3.3 V, and then set the output state to **OFF**.
- Hardware preparation: Take GD32 development board as an example, as shown in ***Figure 2-2. Reference connection of GD32 development board***. The DC-DC circuit on the bottom board converts the 5V power input from the USB port into a 3.3V output, and the 3.3 V output is connected to the 3.3V pad of the module through the jumper cap "J3". Disconnect this jumper cap, and connect the 3.3V output and GND Dupont wires at the DC power output end to pin 2 of J3 and any GND pin (jack) respectively. As shown in ***Figure 5-1. Power consumption test system***, the 3.3 V output and GND Dupont wires are connected to pin 2 of J3 and pin 4 of J6 respectively.
- Software preparation: The firmware is the same as that used in the previous RF index test, named "image-all-rf-test.bin".
- Power-on sequence: First turn the output state of the DC power supply to **ON** to see current change. Then connect the bottom board and PC with a USB cable. After the **Device Manager** of PC identifies the serial port number, you can use the above RF test tool (or the serial port command line) to perform the power consumption test. By taking RF test tool as an example, open **GD RF Test Tool**, connect the serial port, and initialize the chip.

Figure 5-1. Power consumption test system



5.2. Transmitting power consumption test

To test the transmitting current, the transmitting mode with 100% Tx duty (continuous transmitting mode) is recommended, so that the current value displayed on the instrument is 100% power consumption of the transmitting circuit.

- According to the previous section, the test tool has initialized the chip. With reference to ***Continuous packet sending test***, set **Test Item** to **Continuous TX**, then set **Channel**, **Bandwidth**, and **Tx Rate**, and click **Start**.
- The instrument is set to receive the signal and measure the transmitting power. To add power, click **Stop**, modify **Add Power**, and click **Start**.
- Record the current value of the DC power supply.

As shown in ***Figure 5-2. Tx power consumption test***, when **Channel** is set to 3 (2422 MHz), **Tx Rate** to 11G 54M, and **Power Level** to 15 dbm in **Continuous Tx** mode, the average total current of 3.3 V of the chip is 296 mA.

Figure 5-2. Tx power consumption test

5.3. Receiving power consumption test

- It is recommended to perform the receiving power consumption test in the shielded room to prevent environmental changes from interfering with the test results.
- Use an instrument (such as the "waveGen" function of IQXEL) to generate and load a wave file. For the Rx power consumption test, the duty of packets received by the chip should also be close to 100%. When the wave file is generated, you can modify the "wave gap" option to “SIFS” (11 B = 10 us, 11 GN = 16 us) to achieve the maximum receiving duty.
- With reference to ***Receiving test***, set **Test Item** to **Packet RX**, then set **Channel** and **Bandwidth**, and click **Start** in the RF test tool. At this time, the instrument does not send packets. Judge whether the environment is clean through **RxOK** and **RxErr**. The recorded current value of the DC power supply represents the power consumption in the **RX Listen** mode.
- Set the number of packets sent by the instrument to **Continuous TX**, and you can see that the number in **RxOK** in the test tool is increasing. The recorded current value of the DC power supply represents the power consumption in the packet receiving mode.

As shown in ***Figure 5-3. Rx power consumption test***, when **Channel** is set to 6 (2437 MHz), **Tx Rate** to 11B 11M, and **Power Level** to -70 dbm in **Continuous Packet Rx** mode, the average total current of 3.3 V of the chip is 103 mA.

Figure 5-3. Rx power consumption test

6. FAQ

- Q: When the test is performed by entering the serial port command, no log is returned after entering the serial port command.

  A: Confirm the hardware configuration of DUT, and check whether the pins (UART, NRST, PU, BOOT, 3V3, GND) are connected correctly.

- Q: When the chip is initialized in the test tool, failure is displayed.

  A: Confirm whether the version of the firmware burned in DUT is the RF test firmware "image-all-rf-test.bin". Use Husky Tool to confirm whether the serial port communication is normal, and whether the commands such as input mode setting are valid.

- Q: During the test, the instrument cannot capture the Tx signal of DUT (or the power of the captured signal is very small).

  A: Confirm whether the instrument settings are correct, including the mode, port, channel, reference power, line loss compensation, etc.

  Confirm whether the DUT hardware connections are correct, including DUT RF path, RF cable, etc.

  Confirm whether the DUT settings are correct, including the settings of channel, bandwidth, add power, etc.

- Q: The test results of receiving sensitivity are poor.

  A: The solution is the same as that for Q3.

  Check whether the environment is "clean" with reference to ***Receiving test***.

7. Revision history

Table 7-1. Revision history

Revision No.	Description	Date
1.0	Initial release	Apr.7, 2023